(No Model.) 2 Sheets—Sheet 1.

# I. L. ROBERTS.

## MACHINE FOR UTILIZING THE POWER OF THE WAVES.

No. 250,104. Patented Nov. 29, 1881.

Fig 1.

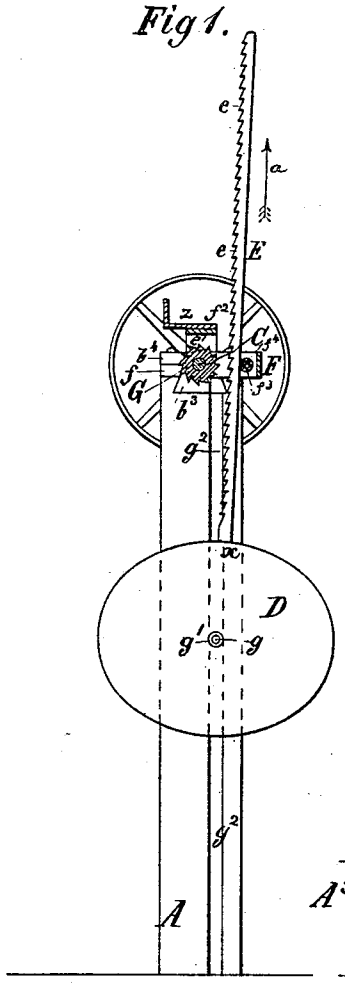



Fig 2

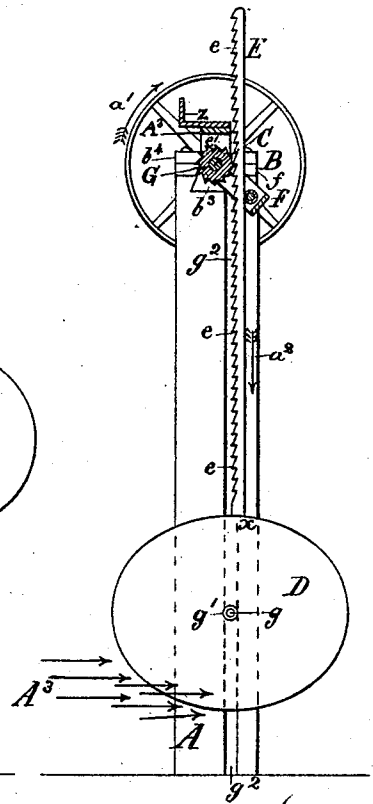



Fig 3

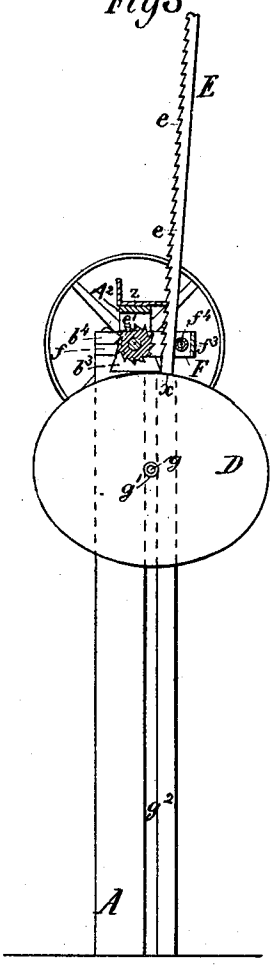
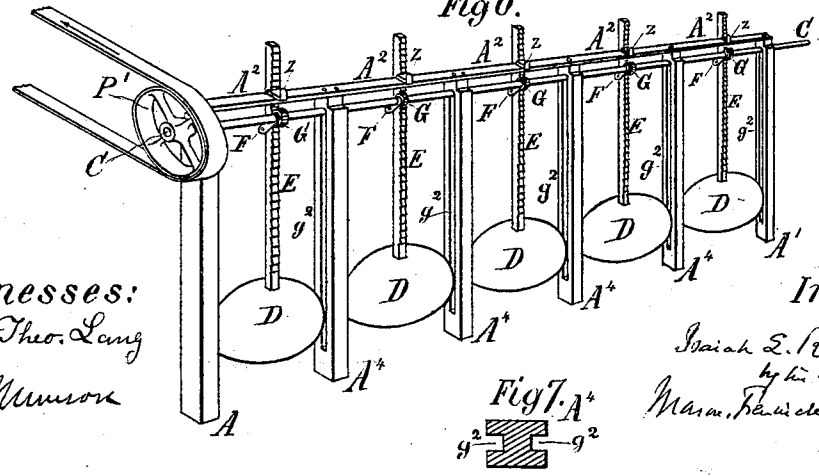



Fig 6.




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Fig 7. A4




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(No Model.) 2 Sheets—Sheet 2.

# I. L. ROBERTS.

## MACHINE FOR UTILIZING THE POWER OF THE WAVES.

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*Fig 4.*

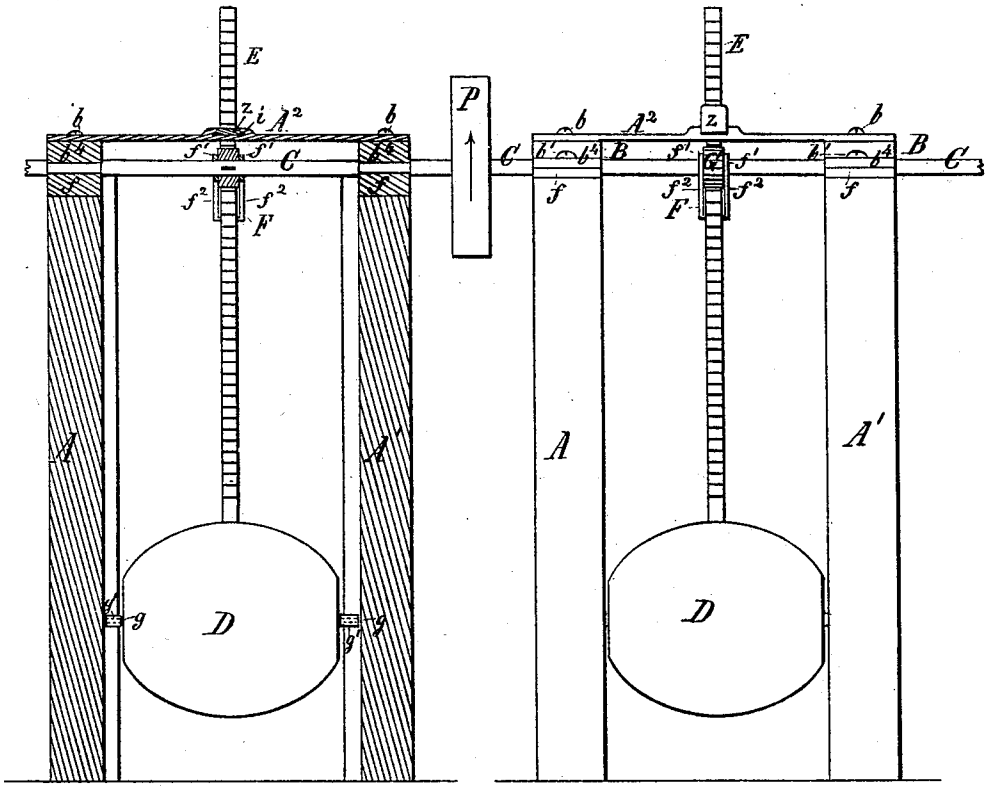
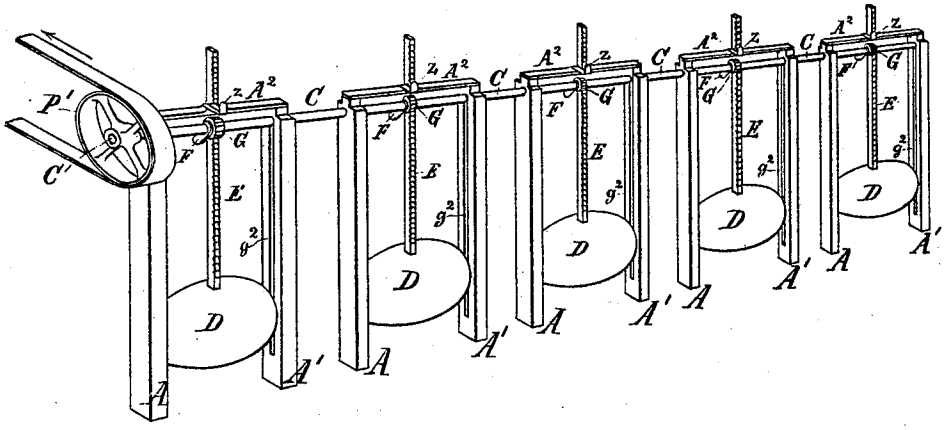



*Fig 5.*




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# UNITED STATES PATENT OFFICE.

ISAIAH L. ROBERTS, OF JACKSONVILLE, FLORIDA.

## MACHINE FOR UTILIZING THE POWER OF THE WAVES.

SPECIFICATION forming part of Letters Patent No. 250,104, dated November 29, 1881.

Application filed April 5, 1881. (No model.)

*To all whom it may concern:*

Be it known that I, ISAIAH L. ROBERTS, a citizen of the United States, residing at Jacksonville, Duval county, State of Florida, have invented certain new and useful Improvements in Machines for Utilizing the Power of the Waves of the Sea and other Bodies of Water; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings and letters of reference marked thereon, in which drawings—

Figure 1 is a vertical longitudinal central section of my improved machine for utilizing the power of the waves of the sea and other bodies of water, said view showing the buoy and its attached ratchet-bar in the act of ascent in the direction of the arrow *a* by reason of the propelling influence of a wave beneath the buoy. Fig. 2 is a section of the said machine similar to Fig. 1, with said buoy and ratchet-bar in the act of descent in the direction of its arrow $a^2$, due to the fall of the wave beneath said buoy. Fig. 3 is a like sectional view with the buoy and ratchet-bar elevated above and out of the way of the waves, and there secured in position by a pawl, *z*, provided upon a cross-bar, $A^2$, upon the columns of the machine, said pawl being adjusted, as shown in Fig. 3, to engage with one of the teeth of the ratchet-bar whenever it is desired to put out of action any one of a connected series of said machines signified in Fig. 5. Fig. 4 is a view showing, for example, two adjoining machines of the series of said machines signified by Fig. 5, and provided with a band-pulley between them upon a driving-shaft common to each, from which power can be transmitted to and utilized at a desired locality. Fig. 5 illustrates a connected series of my improved machines located, for example, along a sea-coast or the shore of a lake or a river, as the case may be; and in this view the pulley for transmitting power I have shown only at the end of the driving-shaft, which is common to all of the machines shown in said series. Fig. 6 is a view similar to Fig. 5, but with four less supporting-columns.

The object of my invention is to provide a cheap and simple as well as effective machine whereby the power of the waves may be made available for driving a cotton or grain mill, for compressing air to be used for propelling street-cars in towns and cities, for furnishing power required in lighting buildings by electricity, and, in fact, for furnishing power for all purposes required in the vicinity of a sea-coast or other body of water where my said machines may be located.

In the drawings, A and A′ indicate columns or posts of cast-iron, which are anchored in any suitable permanent manner in a firm bed of masonry set in the bottom of the sea or other body of water in which my said machine can be operated by the rise and fall of the waves. Said columns are from thirty to forty feet in length, more or less, according to the height of the tide and depth of water, and at their top are provided with strong tie-bars $A^2$, the ends of which are firmly secured by screw-bolts *b* to metallic shaft-bearing boxes B B, which are by bolts *b′* permanently fastened to the columns A A′, as indicated in Figs. 1, 2, 3, and 4. The lower section, *f*, of the shaft-boxes B are in dovetail form, as at $b^3$, and are let into corresponding mortises in the column A A′, as shown, so that when the bolts *b′* are passed through the upper sections, $b^4$, and lower sections, *f*, of the boxes B, and into the columns A A′, a very firm bearing is made in connection with said columns for the boxes B, through which the power-shaft C passes and within which it is made to rotate, as will be hereinafter shown.

D is a metallic buoy, and of globular form, the same being, as I have found by experiment, the strongest and best adapted to resist the concussion of the waves. This buoy is provided with guiding-journals *g*, as shown, and with corresponding friction-rollers *g′* around said journals, to work up and down in longitudinal grooves $g^2$ in the columns A A′ as the buoy rises and falls under the action of the waves.

E is a ratchet-bar, provided with ratchet-teeth *e*, as shown, and is at its lower end firmly fastened to the buoy D at a point, *x*, which is exactly midway of the length of a horizontal plane between said columns, but at one side of the vertical axis of the buoy, as shown. The reason for thus attaching the ratchet-bar to the buoy will be hereinafter explained.

F indicates a swinging gravitating metal yoke, the ends *f′* of which are perforated, and

through which perforations the power-shaft C passes, and upon which shaft the yoke freely articulates upwardly from its position shown in Fig. 2 to its position shown in Figs. 1 and 3 during the ascent of the buoy D and ratchet-bar E, and downwardly from its position shown in Figs. 1 and 3 when the buoy and ratchet-bar descend from their positions shown in Figs. 1 and 3 to their positions shown in Fig. 2. Near the rear end of the yoke, and between its limbs $f^2$, a friction-roller, $f^3$, is provided upon a pintle, $f^4$, which passes through said limbs $f^2$, so that when the buoy D rises and falls the rear or back surface of the ratchet-bar E will have a bearing against the friction-roller $f^3$, while at the same time said bar will be maintained in proper relation to adjacent mechanism, as will be presently explained.

G is a ratchet-wheel fixedly fastened to the power-shaft C, and so as to rotate therewith. It is located on said shaft at a point thereon which is midway between the columns A A′, as shown, and is provided with ratchet-teeth $e'$, as shown, adapted to engage with the teeth $e$ of the ratchet-bar E on its descending movement, as illustrated in Fig. 2, thereby imparting rotation to said shaft in the direction of the arrow $a'$ shown in said figure. The limbs $f^2$ of the oscillating and gravitating yoke F loosely fit against the sides of the ratchet-wheel G, as shown, and thus said yoke, while being capable of freely articulating upon the power-shaft C, serves at the same time to maintain the ratchet-bar E in proper relation to the ratchet-wheel G both in its upward movement, as signified in Fig. 1, and in its downward movement, as signified in Fig. 2.

In the operation of my said machine we will suppose that the buoy D, as represented in Fig. 2, has reached the limit of its downward throw, and that a wave in direction of arrows $A^3$ is just acting against the largest section of the globular buoy at one side of the point $x$, where the ratchet-bar E is attached to the buoy. As the wave advances the action of the same is to "cant" the greater section of the buoy upwardly and its lesser section downwardly, thereby throwing the ratchet-bar E out of its gear with the ratchet-wheel G (shown in Fig. 2) and into its position shown in Fig. 1, thus allowing the ratchet-bar to make a full upward stroke while not in contact with the ratchet-wheel, thereby not only avoiding friction, but the injurious wearing away of the teeth of both ratchet-wheel and ratchet-bar. The wave, now having reached its height, begins to fall, whereupon the yoke F, which has been raised from its position shown in Fig. 2 to its position shown in Fig. 1 during the upward throw of the ratchet-bar, by reason of the impingement of said bar against the roller $f^3$ of said yoke, now by its own gravity falls down and presses the ratchet-bar E into engagement with the ratchet-wheel G, as shown in Fig. 2, thereby rotating the power-shaft C during the descent of the bar E and its buoy D. The power transmitted to the shaft C during the descent of the bar and buoy will depend upon the weight of those parts, and any additional weight which may be supplied to the interior of the buoy, if desired.

In Fig. 4 my globular buoy is shown flattened at two points; but in Fig. 5 the buoy is shown in perspective view without such flattened portions, and this latter form I prefer.

By my constructions, as shown, it will be seen that I utilize a single power-shaft, C, common to a series of my said machines, as illustrated in Figs. 5 and 6, and that any one, or more than one, or all, of the buoys D and their bars E of said series may be brought into action in connection with said shaft C when desired, and that power-pulleys, as at P, may be utilized at intermediate points along said series, or only, as at P′, at one end of the line, or at both ends and at intermediate points, should the same be deemed advisable.

It is apparent that the line of shafting C may be composed of sections coupled together in a well-known manner.

The pawl $z$ for holding the ratchet-bar E and buoy D in an elevated position, as shown in Fig. 3, may have a dovetailed connection with the cross or tie bar $A^2$ in an enlarged portion, $i$, of said bar, as indicated in sectional view, Fig. 4; or said pawl may be connected with said part $A^2$ in any other proper manner.

It will also be seen that under the action of the waves upon the buoy D the ratchet-bar E is made to oscillate within the longitudinal limits of the yoke G, one oscillation of the buoy and bar causing the bar on its upstroke to free itself from the ratchet-wheel G, while by a reverse oscillation the ratchet-bar E on its downstroke is made to engage with said ratchet-wheel.

In Fig. 6 I illustrate my invention applied to a series of columns, each of which has grooves $g^2$ on both sides for the friction-roller journals $g\,g'$ of the buoy D to work in, except the outside column at the respective ends of the series. These outside columns A A′ have the grooves $g^2$ on their inside only. In this manner I use five buoys with only six columns, instead of five buoys with ten columns, as shown in Fig. 5, thus saving the cost of four columns in a series of five buoys. The outside columns in Fig. 6 are indicated at A A′, while the intermediate columns with grooves $g^2$ on both sides are indicated at $A^4$ and shown in cross-section in Fig. 7.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A buoy provided with means whereby it is allowed to oscillate as well as reciprocate up and down under the action of the waves, substantially as and for the purpose described.

2. A buoy, D, provided with a ratchet-bar, E, set out of line with the vertical axis of the buoy, so that the buoy will oscillate on its guiding-journals while it is reciprocated up

and down, substantially as and for the purpose described.

3. The gravitating yoke F, in combination with the power-shaft C, provided with a fixed ratchet-wheel, G, ratchet-bar E, and buoy D, the combination being such that the ratchet-bar shall make an upward stroke free from the ratchet-wheel G and a downward stroke while engaged with the ratchet-wheel, substantially as and for the purpose described.

4. In a series of machines for utilizing the power of the waves, a line of power-shafting, C, operated by buoys D, ratchet-bars E, and ratchet-wheels G, in combination with means whereby one or more of said buoys and ratchet-bars may be thrown out of action along the line of said shafting, substantially as described.

5. The combination of the power-shaft C, a series of buoys, D, and supporting-columns having a groove, $g^2$, on both sides thereof, substantially as and for the purpose described.

Signed in presence of two subscribing witnesses.

ISAIAH L. ROBERTS.

Witnesses:
FREDERICK M. ROBINSON,
J. C. MARCY, Jr.